

## 2.0 PURPOSE AND NEED

Syntroleum Corporation and the U.S. Department of Energy (DOE) are considering development of a small-scale gas-to-liquid fuels plant at the Tulsa Port of Catoosa Industrial Park, near Tulsa, Oklahoma. This Environmental Assessment (EA) is part of the environmental impact analysis process for the proposed action. The EA addresses requirements of the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) as well as subsequent executive orders, Council on Environmental Quality (CEQ) guidelines, and DOE's NEPA Implementing Procedures (10 CFR 1021).

### 2.1 PURPOSE AND NEED FOR AGENCY ACTION

The United States Government, through the Department of Energy's National Energy Technology Laboratory (NETL), is sponsoring a program to develop, manufacture, and test a new generation of ultra-clean transportation fuels for cars, trucks and other heavy vehicles. The goals of this program are to:

- Reduce the United States' dependency on foreign crude oil through efficient, economic, and environmentally friendly exploitation of the nation's fossil fuels;
- Produce liquid fuels that are compatible with the transportation infrastructure and that are formulated to enable advanced, high efficiency engines to achieve ultra-low emissions; and
- As an alternative to domestic petroleum exploitation, develop technologies capable of converting domestic resources to clean fuels that would supplement petroleum in satisfying the Nation's growing demand for cleaner transportation fuels.

New environmental standards for motor vehicle diesel fuel are scheduled for phase-in beginning in 2006. This proposed action would support demonstration of a technological solution that would provide fuel producers with an economical approach to meet the new standards.

### 2.2 BACKGROUND

Under fiscal year 2000 competitive solicitation DE-PS26-00NT40758, Ultra-Clean Transportation Fuels, DOE requested cost-shared applications for research and development in three fuels-related areas. One of those areas was for "the production of ultra-clean transport fuels from fossil resources, and the validation of their performance by testing in engines."

In response to that solicitation, Integrated Concepts & Research Corporation (ICRC) assembled a team comprised of Syntroleum Corporation, University of Alaska, Daimler-Chrysler Corporation, West Virginia University, Massachusetts Institute of Technology's Sloan Automotive Laboratory, and Arthur D. Little, Inc., for preparing a proposal on diesel fuel, which is subject to new U.S. Environmental Protection Agency (EPA)-promulgated fuel quality regulations. Specifically, the new regulations would require domestic fuel producers to apply new technology capable of achieving 97% reduction in sulfur content of marketed diesel fuel.

One approach to produce low-sulfur diesel is to use natural gas, rather than petroleum, as the starting material. Stranded gas fields, such as the large gas field on the North Slope of Alaska, could provide a potentially important source of this feedstock. The proposed effort consists of construction and operation of a plant that uses gas-to-liquids (GTL) technology to convert natural gas to ultra-clean diesel fuel for performance testing and demonstration in engines and fleet vehicles.

Since sulfur deactivates catalysts that would be used in the process, the natural gas feed would be cleaned to an inherently sulfur-free feedstock. The GTL fuels production technology produces fuels containing

contaminant levels below all existing and proposed fuel sulfur limits. The proposed technology would be particularly applicable to processing natural gas that is currently vented at remote oil fields.

Syntroleum Corporation is the developer and owner of proprietary technology (the Syntroleum Process) for converting natural gas into synthetic liquid hydrocarbon fuels and specialty products, and Syntroleum licenses this process to oil companies for use in making synthetic fuels. Syntroleum's GTL technology converts natural gas into synthetic liquids in a two-step process. In the first step, natural gas is reacted with air in a proprietary auto-thermal reformer reactor to produce a nitrogen-diluted synthesis gas (primarily a mixture of carbon monoxide and hydrogen). In the second step, the synthesis gas is processed into synthetic oil using technology based on Fischer-Tropsch chemistry in a reactor containing a proprietary catalyst developed by Syntroleum. The synthetic oil is then refined into synthetic fuels, including diesel and low octane gasoline. The produced diesel fuel is compatible with the existing fuels infrastructure, is virtually free of sulfur and aromatic components, has a high cetane level, and achieves the quality requirements of environmental regulations expected to take effect in 2006.

Following demonstration of essential components of a gas-to-liquids process in laboratory operations, initial patents for the technology were issued to Syntroleum in 1989 and 1990. Construction of a pilot-scale facility was completed in 1990 and operations were conducted through 1991. Between 1991 and 1995, research and development efforts were focused on developing more effective catalysts. The pilot facility was modified in 1995 to test new catalysts and in 1997 to test new reactor configurations. In July 1999, natural gas-to-liquids processing equipment with a capacity of 70 barrels per day was successfully tested at the ARCO (now BP) Cherry Point Refinery near Bellingham, Washington. Syntroleum also demonstrated product upgrading technology at the pilot plant scale. The equipment from the Cherry Point Refinery is available for use at the Tulsa Port of Catoosa Industrial Park to provide basic process components for the proposed production plant.

Synthetic liquid fuels produced by Syntroleum's technology have been evaluated in laboratory and limited road testing since 1997. Based on this testing, the produced liquid fuels received approval in 2000 by the EPA for use as transportation fuels. GTL fuels produced domestically received certification as "Alternative Fuels" under the Energy Policy Act. Syntroleum's synthetic fuels have also been demonstrated in fuel cell applications at DOE's Argonne National Laboratory and by fuel cell manufacturers.

The proposal submitted by the ICRC and Syntroleum Corporation team in response to DOE's competitive solicitation (DE-PS26-00NT40758) contained the following objectives:

- Complete detailed mechanical design, build, and operate a modular, small plant to convert natural gas, via Fisher-Tropsch (F-T) and hydro-processing reactions, into hydrogen-saturated diesel fuel.
- Conduct the following fuels tests:
  1. Diesel fuel in a variety of engines and vehicles to ensure that use of the product would result in acceptable compatibility with fuel injection system components and reduced emissions.
  2. Diesel fuel in prototype engines to demonstrate compatibility with next-generation exhaust after-treatment emission control systems, especially for NO<sub>x</sub> and particulate reduction.

The final stage of the proposed project was to perform an economic analysis using data obtained from the project to predict commercial viability. Table 2-1 identifies the proposed participants in this GTL project and their respective responsibilities and interests.

DOE selected the proposed project, for building and operating a GTL fuels plant and demonstrating performance of product fuels in engine and fleet vehicle demonstration tests, for support, since the

proposed technology, if successfully demonstrated and applied, could potentially achieve the following results:

- Use domestic resources that are readily available in quantities sufficient to support requirements for the large domestic automotive and/or truck fleets;
- Yield ultra-clean designer fuels, free of both sulfur and aromatic compounds, that are compatible with both existing and new automotive and truck engine designs;
- Fit seamlessly into the existing distribution infrastructure; and
- Provide an environmentally friendly operation during the fuels production phase.

**Table 2-1 Project Participants**

| PARTICIPANT   | RESPONSIBILITY   | OBJECTIVE(S)  | COST SHARE |
|---|--|---|------------|
| Integrated Concepts & Research Corporation (ICRC)   | Overall management of the proposed project; dynamometer tests of diesel bus engines; monitor fleet vehicle testing | Prime Contractor  |            |
| Syntroleum Corporation                              | Engineering, construction, and operation of the GTL plant; production of fuel for demonstration testing            | Produce hydrogen-saturated Fischer-Tropsch fuels and demonstrate performance; license GTL technology    | Co-fund    |
| Marathon Oil Company                                | Technical and project management support   | Acquire GTL engineering and operations expertise  | Co-fund    |
| National Park Service                               | Fleet vehicle tests at Denali National Park  | Acquire information on performance of clean diesel fuel for meeting future standards                    |            |
| Washington (DC) Metropolitan Area Transit Authority | Fleet vehicle tests in Washington, D.C.  | Acquire information on performance of clean diesel fuel for meeting future standards                    |            |
| West Virginia University                            | Emissions measurements during fleet vehicle testing  | Generate information on comparative emissions of GTL and conventional diesel fuels                      |            |
| Daimler-Chrysler Corporation                        | Evaluation of fuels in prototype light- and heavy-duty diesel engines  | Demonstrate compatibility of fuels with next-generation engine control systems                          |            |
| University of Alaska, Fairbanks                     | Testing of ultra-clean diesel fuels  | Generate information on use of ultra-clean diesel fuel  |            |
| Massachusetts Institute of Technology               | Optimization testing of engine combustion systems  | Identify engine operability improvements for using ultra-clean diesel fuel                              |            |
| Arthur D. Little, Inc.                              | Economic and energy analyses   | Establish the economic viability of using GTL technology for providing ultra-clean transportation fuels |            |
| U.S. Department of Energy                           | Co-fund GTL facility construction and operation and fuel demonstration tests                                       | Demonstrate production and performance of ultra-clean fuels   | 44%        |
|   |  |   |            |

### **2.3 Scope of the Environmental Analysis**

Environmental factors considered to be the primary issues for the proposed action include noise, land use, transportation, visual resources, air quality, waste management, and socioeconomics. Additionally, consideration was also provided to environmental factors associated with site infrastructure, water resources, floodplains and wetlands, biological resources, cultural resources, Native American concerns, and cumulative impacts.

Consideration of safety and health impacts is limited to potential hazards associated with construction and operation of the proposed fuels production facility. All personnel and contractors that would participate in construction and operation of the facility would be responsible for compliance with applicable Occupational Safety and Health Administration regulations concerning occupational hazards and protective measures for employees.